PATHFINDER

Vol. 5 No. 6

The Geospatial Intelligence Magazine

Serving the Front Line
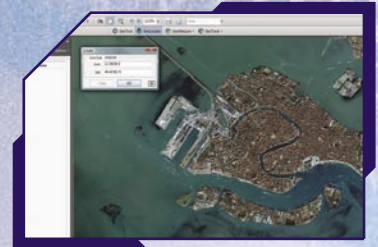
NGA CONVERTS PRODUCTS TO GeoPDF® FILES

'GUNCOAST' AIMS FOR REAL-TIME TARGETING

Technology Expands
GEOINT Capabilities

Technology Advances GEOINT Products and Delivery

Our nation and our allies continue to face a rapidly evolving threat environment. To confront and defeat these threats our intelligence and defense communities, now more than ever, must succeed in the critical task to predict, penetrate and pre-empt threats to our nation and her allies. NGA is at the forefront of this effort, developing new capabilities and harnessing new technology to efficiently manage the available data and ensure our mission partners have timely access to information. These technological advances, new capabilities and innovative solutions aid us in our ability to keep our nation secure.

The drive for new technologies has different meanings for different users. A forward-deployed analyst might use collaboration tools for reachback to a parent organization. An imagery analyst might use new automated tools to ingest, process and review volumes of imagery far beyond a human's capacity to absorb. A cartographer might use new technology to generate new and advanced terrain maps. However, all of our users of geospatial intelligence (GEOINT) have a common need—the ability to collect the right data, access it when they need it and disseminate it to those who are making decisions. NGA looks at these data needs and pursues the technology that can both support and further our mission.

Data Collection: Sensor-Neutral Architecture

NGA is actively building collaborative partnerships to facilitate data-sharing, introduce a multi-intelligence approach, enhance persistent surveillance efforts and improve research and development (R&D) initiatives. In the last four years, NGA has widened its aperture from relying primarily on data gathered by government satellites to a system that also integrates airborne, commercial and foreign data sources. Through improved acquisition processes, NGA is now leveraging an increasing amount of commercially available technology to satisfy the demands of the GEOINT operating environment.

The amount of data that we need to process is exponentially increasing, all of which we need to represent visually. Additionally, the systems used to process this information must be just as robust for our personnel overseas as they are for our personnel in the states. For example, advances, such as NGA Earth, enable our military and government users to access unclassified maps and imagery of hot spots around the world.

GEOINT Dissemination: Access on Demand

Decision makers, warfighters and emergency response personnel's ability to act is reliant on the information available at decision-making time. This means that disseminating timely, relevant and accurate GEOINT to end users in all four corners of the globe is a critical element of achieving mission success. Take the tool Top Drawer as an example. Top Drawer is a storage and retrieval system which is now operational in theater. This tool exists today because analysts decided they needed a central location to store working documents. The key to Top Drawer's effectiveness as a collaboration tool is the standardization of metadata which allows NGA's mission partners to use intuitive search terms to find GEOINT.

NGA's information-technology (IT) enhancements include a movement towards a service-oriented architecture (SOA). This move makes the search and location of GEOINT in an online environment possible. This user-friendly access, also known as data virtualization, will be facilitated by the establishment of data centers that will establish standard storage and processing environments.

NGA's e-GEOINT initiatives are enhancing the data virtualization user experience. The Web-based Access and Retrieval Portal (WARP) has already assisted over 18,000 individual mission partners in finding, accessing and retrieving GEOINT to address intelligence and homeland security challenges. Moreover, the 2008 launch of GEOINT Online (GO) will make GEOINT accessible through publicly available Web browsers, geographic information systems and commercially available visualization and analysis tools.
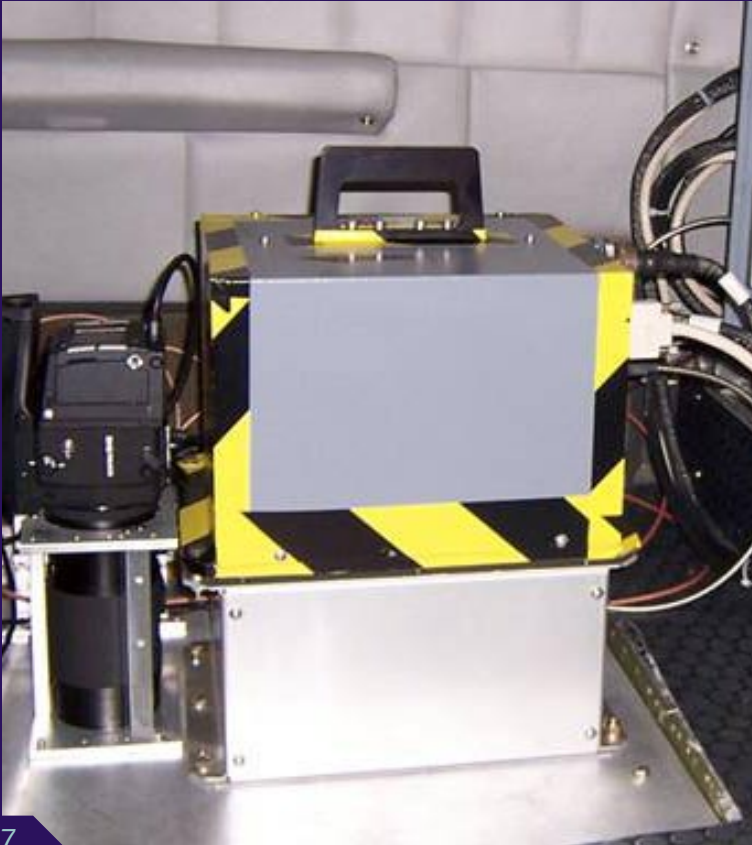
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ON THE COVER

Getting access to the best geospatial intelligence (GEOINT) possible, where and when it's needed, is crucial to the success and safety of today's warfighter. How technology continues to expand GEOINT capabilities by overcoming barriers to access and strengthening its content with new sources and more timely information is the subject of this Pathfinder. This issue also celebrates the groundbreaking for New Campus East, NGA's new headquarters complex at Fort Belvoir, Va. Coverage of the ceremony is on page 3, and an interview with the Director of Security and Installation Operations, Joe Composto, is on page 23. The cover design is by Carmella Bender.

Letter to Our Readers

Enabling Access to the Best GEOINT

On Sept. 25, I was privileged to serve as master of ceremonies for the groundbreaking of NGA's new headquarters complex. To see the start of this momentous building project in the history of our Agency was exciting. Of course, the real benefits will come through the revitalization of NGA's mission, as the Director emphasized in his address. For example, a unified environment, with state-of-the-art systems, collocated with the NGA college and in close proximity to many mission partners, should create ideal conditions for rapid advances.

There's no question NGA professionals in St. Louis and other locations across the map will become even more valuable as enablers of the overall mission. They will serve as a source of stability and consistency as the transition to the new campus accelerates. At the same time, getting the right people together in the right place on our new eastern campus is an objective we can all embrace. To learn more about NGA's New Campus East, read Kate Worley's interview with NGA's Director of Security and Installation Operations, Joe Composto, in this issue.

This Pathfinder is devoted to examining some of the technology challenges that are important to our partners, especially those on the front line. Leading off with "Technology Expands GEOINT Capabilities," NGA Technical Executive Steve Wallach cites the need to improve both GEOINT and access to GEOINT. Our most significant short-term challenge may be improving access to GEOINT. As you read this issue, you will see this challenge being repeatedly addressed, from two articles in our "Up Front" section—"18,000 Get GEOINT, Thanks to WARP" and "GEOINT Online Set to GO in 2008"—to at least three feature articles: "NGA Converting Products to GeoPDF® Files," by Darrell Garrett, explains the enormous potential of the familiar Portable Document Format as a vehicle for accessing NGA products easily and quickly. How consolidated data centers will link NGA work centers with our customers to provide net-centric GEOINT is the subject of Steve Zenishek's article, "Data Centers Are a Technology Breakthrough." And "'Guncoast' Aims for Real-Time Targeting," an interview by Roger Gant with the program's director, Ted Cody, looks at both access and the longer-term challenge of providing new and better GEOINT.

One of the new sources under consideration, synthetic aperture radar (SAR), is the subject of an article by Michael Hales, "NGA Has NextView: Looking at Foreign SAR Satellites." Finally, Pat Grieco discusses the challenges of establishing persistent surveillance, including access and data, in "Achieving Persistent Surveillance Requires Community Effort to Build One Continuum." Our next Pathfinder will highlight some of NGA's achievements in providing operational support to our customers. See you in 2008!

Paul Rudeau (signature)

Paul R. Weise
Director, Office of Corporate Relations

NGA Breaks Ground for Headquarters Complex

By the Office of Corporate Relations

Vice Adm. Robert B. Murrett, NGA Director, hosted members of the Intelligence Community, Department of Defense and NGA workforce on Sept. 25 to break ground at the future site of the NGA headquarters complex, also known as New Campus East, at the Engineer Proving Ground, Fort Belvoir, Va.

"New Campus East will allow NGA to work more cohesively in doing the work that only it can do," said senior guest speaker Army Lt. Gen. Ronald Burgess, Acting Principal Deputy Director of National Intelligence. He also addressed the apprehensiveness that some of NGA's workforce may feel about the move, saying, "We're not at these jobs for the recognition, money or the commute. We're here because we believe in a cause greater than ourselves—the causes of freedom and security." He also congratulated and thanked the NGA workforce for all NGA does for the nation and the Intelligence Community.

Retired Air Force Lt. Gen. James R. Clapper Jr., Under Secretary of Defense for Intelligence and former NGA Director, also made remarks. Referring to the consolidation of NGA east facilities, Clapper noted, "This is emblematic of the continuation of transformation of the agency and the synthesis and melding of mapping, charting and geodesy on one hand, and imagery, imagery analysis and intelligence on the other."

Murrett called the groundbreaking event "a momentous step in NGA's mission deployment to the new campus." He emphasized the idea of consolidation in five key points. First, workforce fragmentation will be eliminated, allowing NGA to reexamine and transform processes and procedures. Second, the presence of the NGA college at the new facility will improve the quality

Photo by Tony Boone

Photo by Larry Franklin

of analysis and tradecraft. Third, the new facility will be constructed with a uniform informational technology infrastructure that will allow for smooth integration of enabling technologies as they emerge. Fourth, this consolidation will accelerate the development of new technologies and products by fusing geospatial intelligence research and development with operations. And fifth, the other core NGA entities in St. Louis will continue to serve critical roles during and after the consolidation in the east.

In closing, master of ceremonies Paul Weise, Director, Office of Corporate Relations, invited eight key players in the consolidation to officially break ground. Among the group was Matthew Davis, an NGA employee who entered on duty the day the Base Realignment and Closure (BRAC) Commission recommendations were signed into law in November 2005. NGA will consolidate its eastern operations at the Engineer Proving Ground, which is in the Springfield, Va. area, by Sept. 15, 2011, in accordance with the BRAC directives. ⊟

NGA Celebrates Launch of WorldView-1

By the Office of Corporate Relations

NGA joined DigitalGlobe in celebrating the successful launch of their WorldView-1 satellite Sept. 18.

"We have enjoyed an excellent working relationship during the development phase over the last four years, with an open dialogue regarding their progress, issues and challenges leading to this significant milestone," said NGA Director Vice Adm. Robert B. Murrett.

"We are excited about and eagerly await delivery of the first new imagery," said Murrett. "With the improved resolution, agility and capacity of the WorldView-1 satellite, we anticipate increasing the use of commercial imagery to satisfy the nation's geospatial intelligence requirements."

Commercial imagery has proven to be useful for a mixture of Department of Defense, intelligence, policy and civil applications. With improved resolution and capabilities, the new Worldview-1 imagery will facilitate even broader applications across the diverse community of geospatial intelligence analysts, military forces and coalition partners, as well as first responders and nongovernmental organizations. P

Photo by the U.S. Air Force

18,000 Get GEOINT, Thanks to WARP

By Maj. Tim O'Hara

The Web-based Access and Retrieval Portal (WARP) is an NGA system that provides worldwide access to geospatial intelligence (GEOINT) at multiple security levels, secret and below. Through WARP, users can search for several types of GEOINT, such as national, airborne, commercial imagery, imagery-derived products and several other types of intelligence.

WARP gives users free access to multiple data sources through a single Web portal without their having to perform searches on individual archives. Specialized hardware and software are not required; users need only have network access and a commercial browser.

Other systems also use WARP as an information broker through WARP's Geospatial Data Service (GDS) interface. For example, the Enhanced Quality Imagery Search (EQUIS) system uses WARP to display imagery footprints on NGA maps. Some of the other systems that depend on WARP to meet their mission requirements are the Battlefield Visualization Initiative (BVI), Broadcast Request Imagery Technology Environment (BRITE) and Threat Human Intelligence Reporting, Analysis and Display System (THREADS).

WARP has grown tremendously since becoming operational in 2002 and today provides access to 14 archives. The system has also been gaining users at the rate of 400 a month. Over 18,000 users at more than 1,500 locations currently have access.

WARP users come from a variety of government departments and agencies including the Departments of Defense, Homeland Security and State, the Intelligence Community and other federal agencies. These users download an average of 30 terabytes of data per month. WARP's rapid growth, in part, can be attributed to its easy-to-use graphical user interface and its extensive access to data. P

Air Force Maj. Tim O'Hara is the WARP Program Manager.
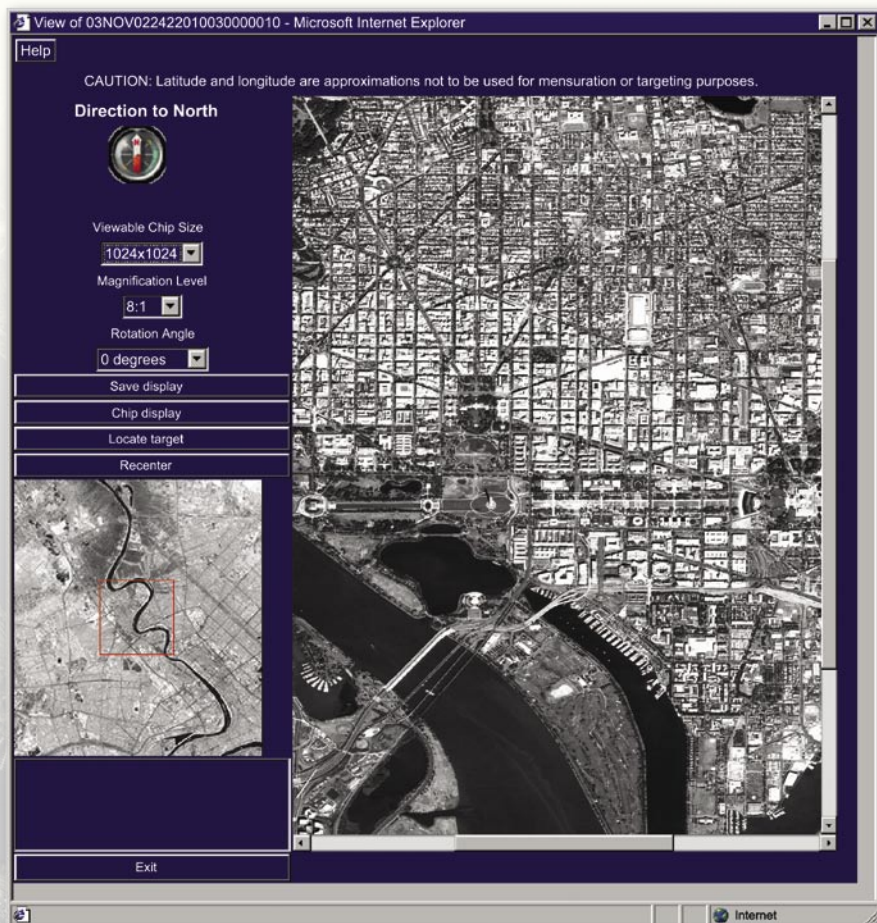
NGA's Web-based Access and Retrieval Portal (WARP) provides access to 14 archives of national, commercial and airborne imagery and imagery-derived products through a single Web portal.

GEOINT Online Set to Go in 2008

By Gary W. Fuller

A new Web-based capability for finding, viewing, analyzing and sharing geospatial intelligence (GEOINT) is set to launch by the end of 2008. GEOINT Online (GO) will integrate several systems, Web sites and capabilities into an environment where partners and customers can intuitively discover and access NGA products and services.

Initially, GO's content will be in the form of standard products, for the most part, while successive versions will increasingly feature seamless layers, or coverages, of GEOINT. These coverages will be accessible through publicly available Web browsers, geographic information systems and visualization and analysis tools like Google Earth™ and ESRI ArcGIS Explorer (AGX)™.

All of GO's data, information and knowledge will also be accessible by customer-unique tools and applications, whether they are mission planning systems, weapons systems, or on-board navigation systems.

GO will provide the best capabilities from systems like Palanterra™, NGA-Earth and Top Drawer. Each of these systems was developed to serve a particular mission segment with a particular type of content. Through GO, their underlying functionality and access to content will be brought together.

GO's combination of a rich set of capabilities and a network-centric approach enabling interaction between providers and users is key to the strategy of collaboration set forth by the Director of National Intelligence. GO will enable the National System for Geospatial Intelligence to become one global, online, collaborative community, capable of sharing GEOINT on demand. �P

Gary W. Fuller

is a Senior System Engineer and Strategic Planner with an NGA contractor supporting the eGEOINT Management Office.

Technology Advances GEOINT Products and Delivery
continued from inside cover

Innovation: Leading Edge Science and Technology

NGA is not only leveraging available technologies to collect and disseminate data, it is also driving the development of new solutions to technical challenges. Our Focus Area to "advance basic research and development of leading-edge science and technology" demonstrates NGA's commitment to forward-leaning solutions. NGA is currently supporting a variety of initiatives, programs and projects to harness innovation and advance the GEOINT discipline. For example, NGA is developing net-centric products to support improved capabilities. Using data fusion and software agent technology, Global Net-Centric Surveillance and Targeting (GNCST) will provide user-specified target reports at the appropriate level of classification.

Our biggest technological advancement will be our mission deployment to the New Campus East (NCE) in Springfield, Va., and our ongoing emphasis on facility enhancement in St. Louis. NCE will be constructed with a uniform and robust IT infrastructure allowing for the smooth integration of enabling technologies as they emerge for decades to come. The enhancements at our facility in St. Louis will ensure that it continues to serve its critical role in providing redundant capabilities and continuity of operations before, during and after our mission deployment in the east.

The talented men and women of NGA are continuing to make a difference ensuring that GEOINT gets into the hands of those who make life and death decisions daily. Technology is critical, but only in that it serves our people and their remarkable ability to move out on the mission.

Robert B. Murrett
Vice Admiral, USN
Director

Technology Expands GEOINT Capabilities

By Steve Wallach

Throughout its history NGA has embraced emerging technology to provide timely, relevant and accurate geospatial intelligence (GEOINT) for our nation. The drive for new technologies has different meanings for different users. A forward-deployed analyst might use new collaboration tools for reachback to a parent organization, an imagery analyst might use new automated tools to ingest, process and review volumes of imagery far beyond a human's capacity, and a cartographer might use technology for terrain generation. NGA pursues all technology that can support its mission.

Partners Drive Direction

A core goal in NGA's National System for Geospatial Intelligence (NSG) Strategic Intent is to forge the future environment by constantly driving technical research and applying technological development to operational needs. Decisions about which technologies to pursue are driven by the needs of NGA's national, military and civil partners. In short, improved GEOINT needs to be more accurate, have improved information content, and be more responsive to emerging national security needs.

To do this we partner with government, industry and academia. We work closely with other government research and development activities, including the Defense Advanced Research Projects Agency, Intelligence Advanced Research Products Activity, other DoD and Intelligence agencies, the service and national labs, and international partners, to collaborate on research and development (R&D) efforts and pool our resources. Partnering with industry, we use commercial technology wherever possible, focusing development efforts on niche areas with little or no commercial market, and align industry's independent R&D with NGA's needs. We forge partnerships with academia to harness the expertise and brainpower of universities for both research and advanced training and education.
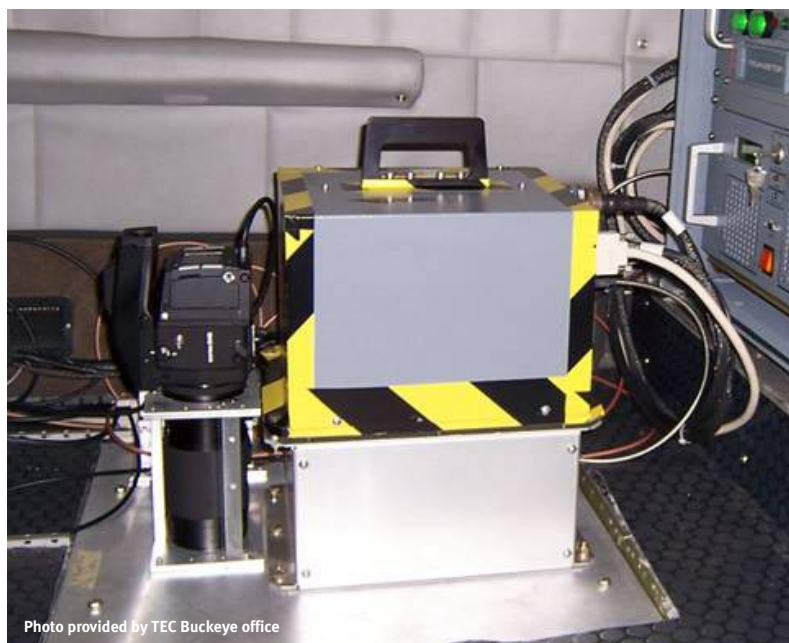
Photo provided by TEC Buckeye office

New airborne platforms and sensors, such as the Army's Buckeye, shown above, will dramatically increase the content and quality of geospatial intelligence.

Growing Sources Expand Capabilities

Years ago we primarily used a single source for both analytic intelligence and geospatial data. Now NGA employs imagery from across the electromagnetic spectrum using both literal and nonliteral exploitation, what we now call advanced geospatial intelligence (AGI). NGA also uses airborne, commercial and Overhead Non-Imaging Infrared (ONIR) imagery. New airborne platforms and sensors, such as the Army's Buckeye and a number of commercial light detection and ranging (LIDAR) systems, will dramatically increase the content and quality of GEOINT. We are also now working closely with the Army and Marine Corps on broader-area persistent imagery collectors such as Constant Hawk and Angel Fire and are standing up a Joint Persistent Surveillance Integration Office to integrate these sources into our enterprise architecture.

Likewise, over the last several years our ClearView imagery partners have delivered unprecedented commercial imagery quality, and follow-on NextView systems being delivered by Digital Globe and GeoEye will be tremendous steps forward. These systems will dramatically increase the

area coverage, resolution and accuracy of commercial imagery and significantly improve revisit and response times.

We are also investigating and will increase our use of foreign commercial imagery. Recently launched systems such as Germany's TerraSar-X and Italy's Cosmos Skymed, along with Canada's soon-to-be-launched Radarsat 2, show great promise in supporting NGA's mission.

Additionally, our ONIR capability is dramatically improving, transitioning from being squiggly lines for an expert image scientist to interpret to a true persistent imaging capability for our analytic workforce.

We need to think of these as a complementary collection of imaging systems, none of which totally meets our GEOINT needs alone. But together they provide a vast capability to meet our current and future GEOINT needs for the community. With this increase of new sensors and nonliteral (AGI) exploitation, our analytic workforce will need to become more knowledgeable on the capabilities of these new sensors, and we will need to increase our numbers of imagery scientists to assist our analysts.

We've also worked closely with our mission partners to better integrate the various forms of intelligence (signals intelligence, human intelligence, etc.), sometimes referred to as horizontal integration. We now have better access to these various sources, tipping and cueing one another and creating fused intelligence analysis to provide a better product to the all-source analysts and our operational users.

We are also working hard to improve access and discovery of these various sources and our GEOINT. We have used Palanterra™ to support a variety of operational needs over the past few years, and we've had NGA Earth providing access at the unclassified level, most notably using Microsoft® Virtual Earth™ to provide commercial imagery to the general public following Hurricane Katrina. In June we launched our GEOINT Visualization Service (GVS) on classified networks. GVS uses Google Earth™ to provide more streamlined access to our GEOINT across the entire NSG enterprise. Over the next few months we will add a similar, but more robust, analytic capability using ESRI's ArcGIS Explorer™, and we're using the Top Drawer and Analytic Spatial Data Initiative to provide storage and access to our nonstandard GEOINT holdings, increasing the availability and reuse of data across the NSG community.

When you add all this to our increased use of open source and commodity data, it's apparent that we are producing our GEOINT from a broad array of sources of varying qualities. This makes standards and metadata, or descriptive data about our GEOINT, absolutely critical. In a perfect world we would provide perfect GEOINT. However, since this is not the case, we owe it to our partners and operational users to clearly define the quality of our GEOINT. This includes indicators of both the quality and confidence of our analytic products and our geospatial data (currency, datum, accuracy, content, etc.).

Updating Processes

So we've come a long way, but are we where we need to be? Absolutely not.

While we've added tremendous capabilities, we have to make it easier to access and use GEOINT. Security policy issues challenge our effectiveness because sources and

users span all levels of security. We need an architecture with multilevel security that allows broad access to GEOINT sources and information through a single log-on. As Adm. McConnell said when he came on board as the Director of National Intelligence, "We need to change our way of thinking from need to know to need to share."

Though legacy cultures sometimes inhibit our taking full advantage of new capabilities, technology and policy can also be limiting factors. In our fast-paced world of seemingly never-ending crises, we must not only focus on the mission but make time to import new capabilities that will save work for our analysts. NGA is also working closely with other DoD and Intelligence Community components to move to a service-oriented architecture, which, along with a more iterative spiral development process, will improve response to operational needs with "plug and play" capabilities (sources and services) instead of the longer development timelines of the past.

We will continue to evolve our processes to effectively manage information, and we will try to glean every bit of information possible from across the electromagnetic spectrum. We will also expand our efforts on broader field-of-view persistent imagery collectors and exploitation and work to automate and move upstream processes (automated change detection, target recognition, terrain generation, etc.). Our goal is to free our workforce to spend more time on analysis and other activities that require human interaction.

As we take advantage of these new technologies and automation, we must ensure that we don't become totally reliant on them. We must maintain expertise in our core sciences and techniques that underlie our tradecraft, which include the following:

» Remote sensing and imagery science
» Photogrammetry and geomatics
» Geodesy and geophysics
» Geographic information systems and geospatial analytics
» Cartographic science

We will continue to pursue the best and brightest candidates from diverse backgrounds for employment at NGA. We will also continue to develop the technical and analytic expertise of our workforce through the broad curriculum provided by NGA's college and our Vector Training Program. Offering advanced formal education, the Vector Training Program is a model for the community and arguably the single greatest benefit NGA offers its workforce.

The responsibility of our Director to serve as Functional Manager for the NSG requires NGA to continue its leadership in GEOINT research and development and analytic tradecraft. With our world-class workforce and the community working together, I am sure NGA is up to the challenge of providing the GEOINT to ensure our nation's security. ▱

STEVE WALLACH assumed his current position as NGA's Technical Executive, where he serves on the Agency's Executive Committee and leads NGA's transformation efforts, including advancing geospatial intelligence, and moving towards Foundation-Based Operations for the community.

NGA Converts Products to GeoPDF® Files

By Darryl Garrett

NGA is converting its products to a specialized form of the Portable Document Format (PDF). The new format—GeoPDF®—has enormous potential for transforming the way NGA supports its customers because it can be read with the Adobe Acrobat Reader® installed on nearly every personal computer and many mobile devices. By downloading a free GeoPDF® Tool Bar for Adobe Reader®, customers can perform a variety of viewing and editing functions.

GeoPDF® was created by Layton Graphics as part of the eChart initiative undertaken by the National Technology Alliance (NTA) in 2004 to digitize NGA's nautical charts. The NTA is a government program aimed at discovering, initiating or accelerating commercial technology to meet the needs of national security and military defense. NGA is the program's executive agent.

At the same time, Layton Graphics formed a new company, TerraGo® Technologies, to create applications for converting complex geographic information to the GeoPDF® data standard. The suite of tools is called Map2PDF®. This software enables geospatial analysts to embed GEOINT into PDF maps created from any geographic information system (GIS) or mapping application.

Two Formats Provided

GeoPDF® has two file formats—raster and vector. Both formats provide scalable digital map displays. The raster files are created by scanning existing paper maps that are saved in a PDF format. The vector files are created by plotting points, lines and polygons to represent different map features, which are saved in layers that can be turned on or off.

GeoMark Enable, a tool created by TerraGo®, allows users to add annotations, drawings and symbols on a georeferenced layer of a GeoPDF® map. The annotated layer can then be sent to other users or imported into NGA systems in a GIS file format.

Through the NTA, TerraGo® has also developed a prototype capability for displaying GEOINT sources and supporting data.

Why Use GeoPDF®?

GeoPDF® enables users to read layered, georeferenced map and imagery products with the tools they already have and without being a geospatial expert. NGA standard products formatted as vector GeoPDF® files are up to 80

percent smaller than previously possible, which means that products can be e-mailed as attachments or easily downloaded from Web sites. Users can download GeoPDF® map files and print them on their local printer, which provides the potential to make NGA's geospatial product distribution more flexible and responsive.

With GeoPDF® maps, users can:
» display coordinates in latitude/longitude, Universal Transverse Mercator (UTM) or screen units
» zoom to points by coordinates
» display bearing, length and area measurements
» maintain layers within maps and turn the layers on and off
» display tracks and locations from the Global Positioning System
» create spatial bookmarks and hyperlinks
» print maps to any desktop printer
» use Adobe® collaboration tools in conjunction with maps
» add georeferenced notes, symbols, drawings and rich media to maps and share them with others
» distribute products via e-mail, Web-based networks, DVD or CD-ROM, due to their relatively small file size.

Agencies Adopting GeoPDF®

GeoPDF® is rapidly becoming a preferred distribution format. The U.S. Geological Survey (USGS) is using GeoPDF® to make its 1:24,000-scale quadrangle maps (quads) available online as a free service. More than 60,000 quads were converted to GeoPDF® files in the initial project.

The Army Corps of Engineers Topographic Engineering Center (TEC) is using GeoPDF® to create country DVDs. TEC is scanning standard NGA map sheets, converting them to GeoPDF® files and packaging them with a thumbnail index on a DVD. So far map scans for five countries have been completed and distributed to Army field units.

"Having NGA products on one DVD for use in a demand-based replication environment was an astonishing sight for most people," said a TEC cartographer involved with the project.

TEC also is converting its Urban Tactical Planners (UTPs) into GeoPDF® vector files and will produce all future UTPs in this layered format.

Other agencies adopting GeoPDF® include the Depart-
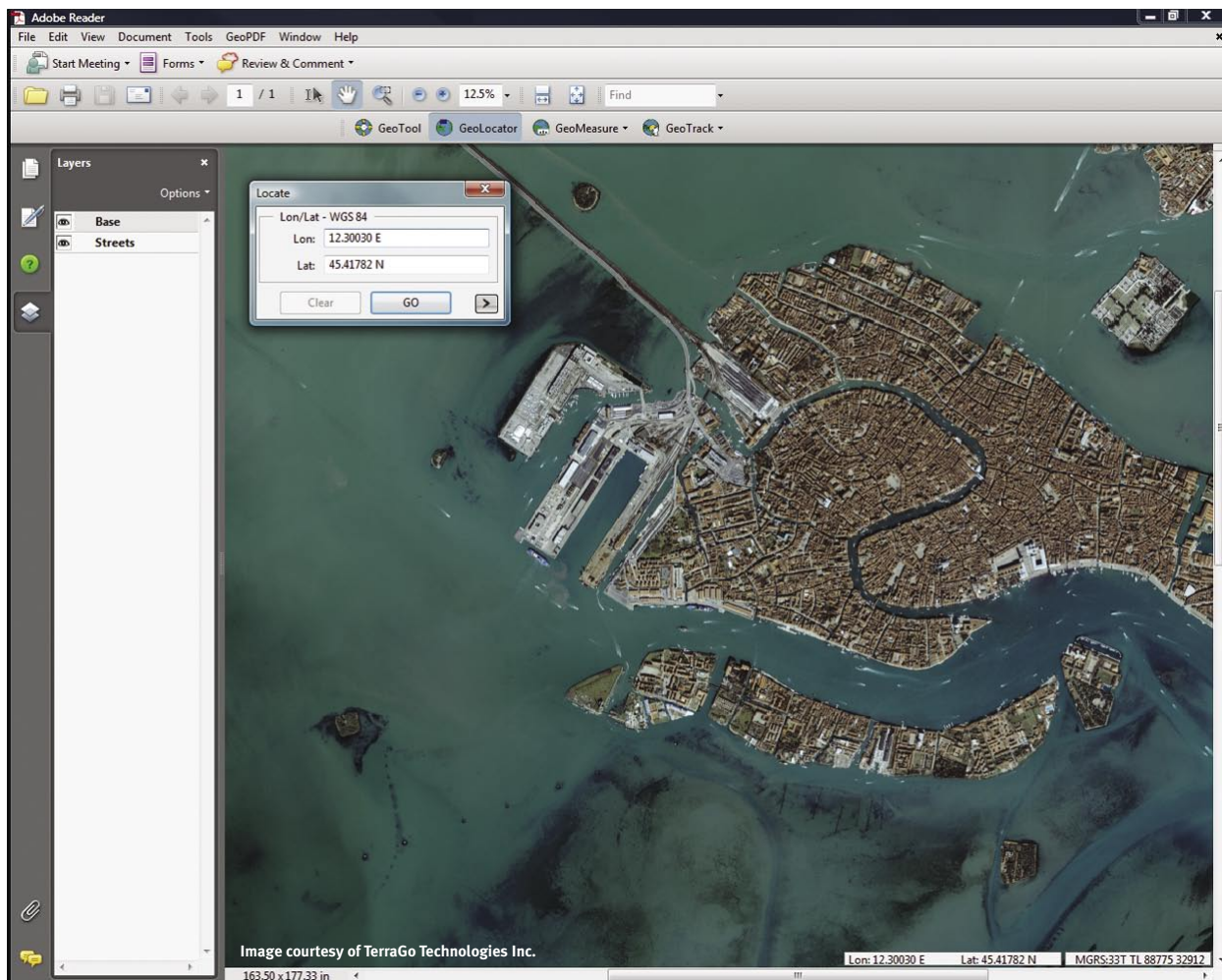
The GeoPDF® format is portable geospatial data that leverages Adobe Reader for ubiquitous access to intelligent, interactive maps.

ment of Homeland Security/Federal Emergency Management Agency, Department of Agriculture, U.S. Secret Service, Department of State and National Oceanic and Atmospheric Administration.

Two commercial-imagery providers—GeoEye and DigitalGlobe—also have the capability to produce imagery in GeoPDF® .

NGA Products in GeoPDF®

At NGA, GeoPDF® technologies have played a major role in transforming both existing standard geospatial production and modernizing operational GEOINT support.

The initial GeoPDF® products included prototype digital atlases for selected areas of Iraq, developed by the Global Foundation and Central and Southwest Asia Offices.

GeoPDF® versions of NGA's GEOINT Contingency Packages (GCPs), formerly called, in hardcopy, Noncombatant Evacuation Operations Packages, or NEO-Packs, have also been developed. GCP also incorporates Geospatial Intelligence for Operations Support and the Battlefield (GIB) in a merger of these two products.

In support of the upcoming Summer Olympic Games, analysts from the Asia-Pacific and Global Foundation Offices have created a new digital image city map of Beijing in GeoPDF®.

The Source Operations and Management Directorate Research Center contracted directly with TerraGo® to scan and georeference 40,000 NGA and native (foreign) products into the GeoPDF® format, based on countries of

interest. By late summer, large portions of 136 countries had been converted. TerraGo® also produced GeoPDF® files for worldwide coverage of Operational Navigation Charts (ONCs, 1:1,000,000 scale), Tactical Pilotage Charts (TPCs, 1:500,000 scale) and Joint Operations Graphics (JOGs, 1:250,000 scale).

Customers now have Web-based access to over 12,000 GeoPDF® files and an electronic index for browsing. As many as 1,000 GeoPDF® files can be downloaded at a time. USGS quadrangle maps are also available through the Research Center.

NGA Support Using GeoPDF®

The Global Foundation and Precision Engagement Offices are currently using GeoPDF® for a variety of uses ranging from homeland security to allied humanitarian and peacekeeping missions in Africa.

Global Foundation analysts have demonstrated GeoPDF® versions of NGA products with Adobe Acrobat Reader® to many customers. The technology is currently being used by

- » the Department of State Diplomatic Security Command Center and regional security officers, who are using it to improve force protection and train embassy security personnel
- » protective service details of the Department of State and Secret Service, who are using it for city familiarization and dignitary security planning with help from NGA Support Teams
- » U.S. allied coalition forces and Iraqi security forces, which are using the Iraq country and urban area atlases for operational and tactical planning.
- » U.S. Marine Corps units for mission planning related to U.S. diplomatic facilities
- » the U.S. Agency for International Development and U.N. forces in Africa for humanitarian missions in the Darfur region of Sudan and peacekeeping efforts in Somalia.

In 2006 NGA, along with the CIA and Defense Human Intelligence Management Office, invested in TerraGo® through its partnership in In-Q-Tel, an independent not-for-profit strategic investment firm that engages with high-tech start-up companies on behalf of the CIA. NGA joined as a partner in In-Q-Tel in 2002. Part of that investment called for each agency to get 25 free Map2PDF® licenses, which the NGA In-Q-Tel team distributed to NGA

Support Teams and geospatial analysts in the Analysis and Production and Source Operations and Management Directorates.

To support initiatives in the U.S. Central Command (CENTCOM) area of responsibility, the Enterprise License Office, in partnership with Adobe®, TerraGo® and Carahsoft Technology Corp., is providing approximately 500 Map2PDF® enterprise licenses. The partnership also includes enough user licenses for GeoMark Enable to support all of NGA's end-users in the CENTCOM area of responsibility. The Analysis and Production Directorate's CENTCOM Reachback Office is also funding Map2PDF® and GeoMark Enable licenses for offices directly supporting Operation Iraqi Freedom. The purchase includes Adobe® LiveCycle Policy Server and Reader Extension Live, which will allow NGA to provide digital rights security on maps and track usage.

Challenges Ahead

Sometimes NGA transformation is like playing in a symphony orchestra: A composition is laid out with each musician knowing his or her parts, being careful to stay within the rules. In contrast, the move to GeoPDF® as an NGA distribution format of choice feels more like jamming in a jazz quartet: Individuals riff on the musical theme within their areas, but stay true to the tune. Offices from across NGA have worked on this transformation because they see the advantage that it provides to their customer. GeoPDF® is already approved as a standard product for the Imagery Exploitation Capability (IEC) workstation, and the TerraGo® software suite is going through certification and accreditation. The final goal and challenge is to have the software installed as a standard part of the NGA Enterprise suite, so that all analysts who need it will have it. ⊏

Darryl Garrett was Director of the Technology Office at the National Imagery and Mapping Agency (NIMA) from 1996 to 2000. He is now a consultant to NGA, formerly NIMA.

Data Centers Are a Technology Breakthrough

By Steve Zenishek

NGA is all about information—it gathers data sources, exploits data, integrates various kinds of data, shares data and collaborates in its exploitation. These are core activities for an intelligence operation. The ability to store massive amounts of data, move the right data to the right place in timely fashion, exploit it collaboratively—these are intelligence imperatives.

At a time when electronic communications were slow and costly, NGA (and its predecessors) fielded hundreds of libraries across the globe. Today, with improved networks and bandwidth, operating and maintaining small, distributed libraries is becoming cost-prohibitive. For example, installation of software upgrades to libraries takes so much time that by the time the last site is upgraded, sites that received the upgrade earlier have already begun installation of the next software version.

Data Centers Are the Answer

As in the private sector, data centers are the clear answer. The role of the data center is to consolidate data holdings into one data storage and processing environment. This data (and value-added information from other parties) is then visible through Web services. The availability of that data and more efficient functionality allow better collaboration based on information that all involved analysts can see.

Data centers also enable data virtualization—the display of current information tailored to the needs of the individual end user but always in the context of a foundation data set (imagery or maps or both). In the future NGA data centers will link to data centers of other mission partners to obtain additional intelligence sources and analysis.

The ability to collaborate between organizations by exposing and sharing data is the basis for net-centric warfare, which theorizes that an enterprise composed of interconnected nodes increases mission effectiveness exponentially as the number of nodes increases linearly. The data centers enable net-centric geospatial intelligence (GEOINT) by breaking down existing data "silos" and linking NGA work centers with our customers in an integrated enterprise of interconnected nodes.

Photo by Dick Fonner

Advanced concepts like net-centric warfare are studied and developed in the laboratory environment of NGA's Geospatial Intelligence Advancement Testbeds. To enable net-centric warfare, NGA is developing plans to link its data centers with those of mission partners.

With Data centers, a team in one area of responsibility (AOR), for example, the U.S. Central Command AOR, is not limited to information within its own library. The Data Center's multiple nodes, consisting of commands, ground stations, analysis centers and other mission partners are enabled to collaborate across the National System for Geospatial Intelligence (NSG). As a result, the team's analysts and operators have the capability to collaboratively develop the GEOINT they need to complete a mission in near real time.

Data centers will play a critical role in the NGA move to its New Campus East (NCE) in the next three to four years. Their use will mitigate risks associated with the consolidation of many data stores as systems and personnel move. Imagery libraries will migrate to the data centers before the NCE move and make the data accessible across NGA. Once the data is migrated and operations are ensured, internal users will move to the NCE without risk to mission continuity. An additional benefit will be the improved ability of analysts in the Washington, D.C. area to collaborate with analysts in the St. Louis area using a richer data set. Ongoing studies of the network throughput will identify and fix bottlenecks prior to any move to ensure mission continuity.

Photo by Dick Fonner

Data centers will play an important role in unifying NGA, the National System for Geospatial Intelligence, and the Intelligence Community.

NGA Is Moving to an ISP/ASP Model

Operation of the data centers will transform the way NGA currently operates, moving to an infrastructure service provider (ISP) and application service provider (ASP) model. In this new construct, NGA's Enterprise Operations Directorate will provide the necessary infrastructure to run software applications and communications. The Acquisition Directorate will provide the application software that will "ride" that infrastructure. An important concept will be the implementation of capability planning, through which changes in applications and infrastructure will be forecast and changed. The goal is to anticipate needed changes in mission. To make this possible, NGA and its partners will collaborate, identifying trends, future needs and emerging requirements.

Data centers will not be restricted to just GEOINT data and applications, but will also include business management capabilities and data. This will enable collaboration among various NGA organizations on business processes such as human resources. Imagine an environment in which human-resource specialists have immediate access to both current information and online tools in a manner similar to the collaboration among dispersed GEOINT analysts. The bottom line: Data centers will play an important role in unifying NGA, the NSG and the Intelligence Community. ⊓

Steve Zenishek

is an NGA Staff Officer in the Acquisition Systems Office, Acquisition Directorate. An Air Force veteran, he was a program manager for the Air Force Distributed Common Ground System. He also served as a crew commander for Minutemen ICBMs and Ground-Launched Cruise Missiles.

'Guncoast' Aims for Real-Time Targeting

By Roger Gant

The Global Net-Centric Surveillance and Targeting *(GNCST) program, or "Guncoast," is an activity of NGA's InnoVision Directorate.*

Representing a potentially transformational capability, GNCST promises to shorten the targeting process, providing near real-time intelligence on targets that users specify with the precision they need to act. The system automatically performs multi-intelligence data mining and fusion in direct response to user queries and then responds with timely, relevant and actionable intelligence at a usable classification level.

An article—"'Guncoast' Promises Transformational Capability"—appeared in the November-December 2006 Pathfinder. In this issue, GNCST Program Manager Ted Cody provides a status report.

Ted Cody, GNCST Program Manager

Q: Please summarize the GNCST program for us.

A: This is a great success story in the making. GNCST uses cutting-edge data-fusion technology to produce actionable information on high-value targets—faster and with more precision. It addresses the toughest challenges of military users and national agencies.

Q: So what's the status of GNCST now?

A: We've made significant progress since we awarded the GNCST contract in July 2006. We're on track to transition to operations over the next few years. Our current effort is scheduled for demonstration as the Pathfinder goes to press. Over the next year, we'll focus our next capability on expanded targets, data sources and fusion techniques, which should be ready by next summer. Transition to operations happens after that.

Q: How does GNCST function?

A: It starts with a user's request to find a particular type of target within a specified area of interest. Based on this, GNCST extracts key information from a variety of data sources. This is done "upstream"—before the data is processed—to get richer data, faster. The extracted information is algorithmically fused to locate and track the specific high-value target. Multiple
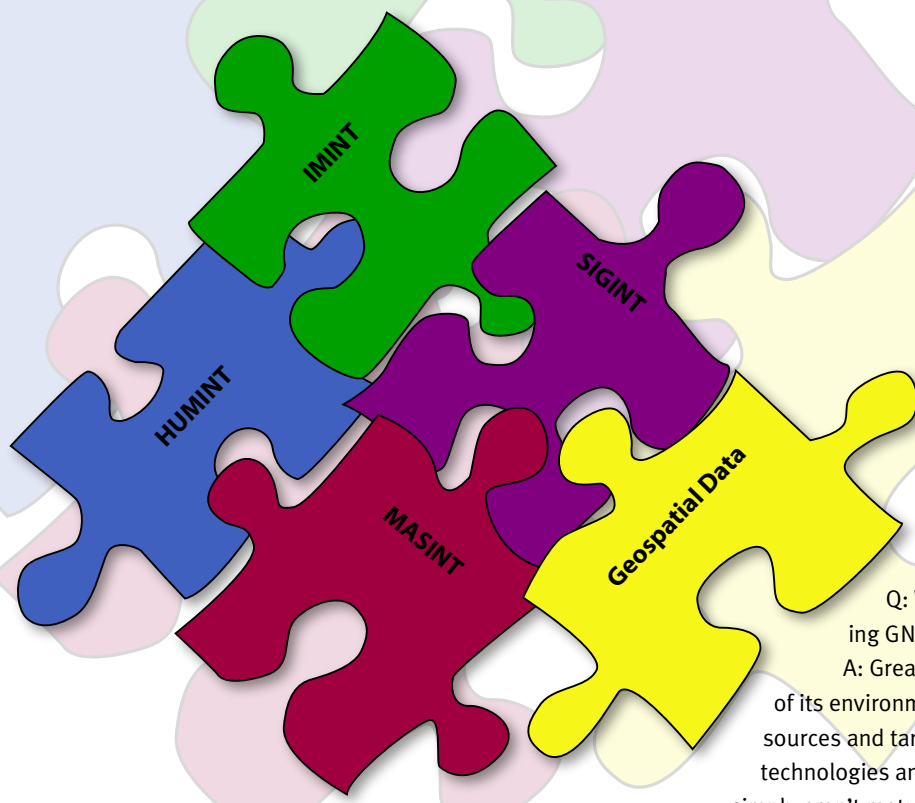
GNCST—Putting the "INT" pieces together.
Graphic provided by GNCST PMO

sources identify a target that a single source couldn't. Automated algorithmic fusion speeds up the process and leverages a larger amount of data. When GNCST finds a target, it notifies the requestor with the location, time and identity. The best part is that users will just need a Web portal to access GNCST, no new software. Additionally, GNCST will be interoperable with the rest of the community using NGA's evolving service-oriented architecture. While it sounds easy, putting it together is tough.

Q: What types of targets can you find now, and what data sources do you use?

A: We've proven the fusion capability against a limited set of military targets, and we're working hard to add more targets to our baseline. However, threats to our nation today are not limited to traditional military forces. We are engaging with potential national agency and military users to prioritize target classes (types) and focus new sources, including tactical sensors, to our baseline in annual spirals.

Q: What's the toughest part of making GNCST fully functional?

A: Great question. GNCST is a product of its environment: We're only as good as the sources and target models available to us. Many technologies and sources of potential interest simply aren't mature enough for GNCST's upstream, algorithmic approach. That's why we're eager to partner with developers of enabling technologies.

Q: Last question—Why is GNCST so important?

A: Our analysts and sensing systems are very good at finding things, but this is very challenging, due to operational imperatives for speed, accuracy and volume. GNCST helps by finding objects that usually don't want to be found and that pose significant challenges for existing approaches that rely on a single intelligence discipline. No one has fused information algorithmically, using multiple intelligence sources, like we're doing. GNCST's attributes, namely its net-centric ability to automatically detect and locate targets through raw data fusion, will maximize the utility of collected data, enhance analytic efforts and enable faster and more effective decisionmaking. P

ROGER GANT
is a contractor supporting the GNCST Program Management Office as a Principal Program Analyst. He served as an Air Force officer with assignments including intelligence analyst, military attaché and systems analyst.

Looking at Foreign SAR Satellites

By Michael Hales

A speaker at a remote-sensing conference recently said that 80 percent of all information has a geospatial component. If true, one would believe that the growing availability of geospatial information is enabling its wider use in our daily lives. Now that DigitalGlobe's WorldView-1 is in orbit, even more geospatial capabilities will be available to the public. WorldView-1 was launched through NGA's NextView program, which acquires satellite and remotely sensed imagery from commercial providers through a competitive selection process.

Commercial space systems outside the United States are also providing, or will soon provide, new geospatial capabilities of immense value to NGA. Determining how NGA (on behalf of its diverse customer base) will evaluate, acquire and use this data is a significant component of NGA's Focus Area involving the development and execution of a comprehensive commercial imagery strategy. Using data from commercial space systems outside the United States also supports the Focus Area goal of being the "most collaborative partner with the Intelligence Community and warfighter." (These and other NGA Focus Areas were the subject of a series of reports under the heading "NGA Moves Ahead in Focus Areas, Looks to Future Challenges," in the September-October 2007 Pathfinder.)

Synthetic Aperture Radar

Synthetic aperture radar (SAR) is a form of radar that can be used for remote sensing through manipulation of the radar data during post-processing. The availability of foreign commercial SAR data is increasing dramatically with the launches of Italy's CosmoSky Med-1 (June 7, 2007) and Germany's TerraSar-X (June 16, 2007), along with the upcoming launches of Canada's RADARSAT-2 and Cosmo Sky Med-2 (both in December 2007). CosmoSky Med-1 and TerraSar-X are the first satellite missions in their multisatellite constellations, whereas RADARSAT-2 will join an existing system already in orbit. South Korea is also planning to launch KOMPSAT-5, a high-resolution dual-use SAR system, in 2008. This is part of South Korea's 20-year National Space Plan through 2015.

Foreign data-sharing partnerships and the foreign purchase of turnkey systems are also on the rise. European countries like France, Germany and Italy have pioneered
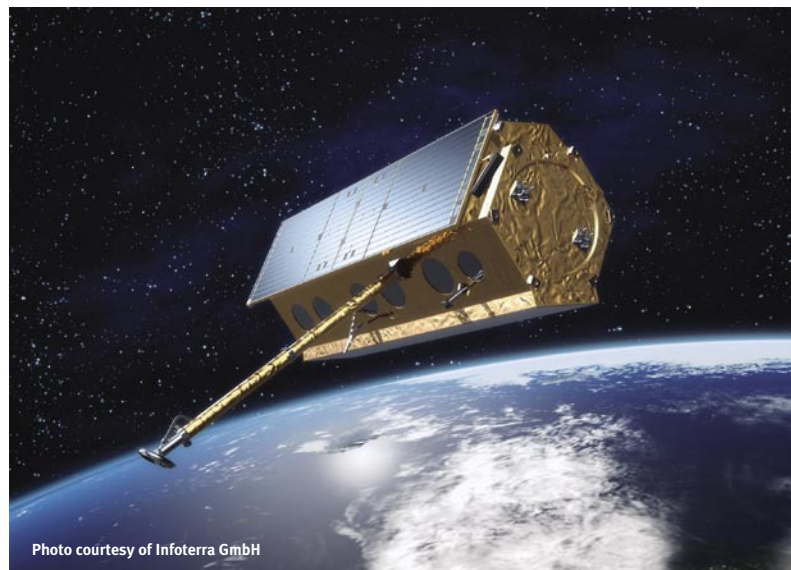
Photo courtesy of Infoterra GmbH

Commercial space systems outside the United States are providing, or will soon provide, new geospatial capabilities of immense value to NGA. Shown above is Germany's TerraSar-X, launched in June 2007.

data-sharing arrangements among their collective commercial electro-optical (EO) and SAR space systems. This approach has proven to be both cost-effective and exclusive since each country shares its commercial remote-sensing resources but has knowledge only of its own encrypted telemetry and downlink activities.

In some countries, commercial companies are also selling satellite system designs and/or turnkey systems. An example of the latter is Israel, which is marketing an impressive 300kg turnkey SAR system for a very competitive price by satellite standards. Even the United States is competing to provide turnkey EO and SAR remote sensing systems to a consortium of allied Middle Eastern countries. No matter how you look at it, the foreign demand for SAR data and its geospatial applications is growing.

Why SAR?

SAR imagery has some obvious advantages over EO imagery because it is not dependent on daylight or fair weather to acquire remotely sensed information. It is also extremely useful for developing digital elevation models used by scientists, academics and analysts from all sectors of government. On behalf of the United States in

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2003, NASA and NGA (known as the National Imagery and Mapping Agency at the time) received global appreciation for processing and distributing Shuttle Radar Topography Mission (SRTM) Level-1 data (nominal post spacing of 90 meters) very openly and for making Level-2 data (nominal post spacing of 30 meters) selectively available to U.S. government-approved users. These datasets, still being widely used today, include highly accurate interferometric SAR (INFSAR) data from February 2000 covering approximately 80 percent of the Earth's land mass between 60 degrees north and 56 degrees south latitudes.

In 2009, Germany's planned TanDEM-X mission will join the recently launched TerraSAR-X and provide commercial IFSAR data corresponding to Level 3 of NGA's Digital Terrain Elevation Data, with geolocational accuracies of approximately 10 meters. Over a three-year period, TerraSAR-X and its twin TanDEM-X will create a detailed global elevation dataset. Meanwhile, the SRTM data will remain unique because no U.S. or foreign commercial entity is planning to collect, process and archive such a comprehensive SAR data collection.

NGA's Evaluation of Foreign SAR Data

NGA's Technical Executive is currently conducting a data-evaluation study to examine the quality of SAR data from three of the foreign commercial systems mentioned above. The missions being evaluated include Germany's TerraSar-X, Italy's Cosmo SkyMed-1, and Canada's RADAR-SAT-2 satellites. The purpose of this SAR data evaluation is to examine how foreign commercial SAR data may satisfy Department of Defense and Intelligence Community requirements, especially in the areas of broad area search, macro change detection, mapping applications (including feature extraction and disaster response), intelligence applications, elevation and subsidence data, and possibly even support for targeting.

By conducting the study, NGA is also developing a comprehensive understanding of the future commercial SAR capabilities coming online before 2012 as part of a larger acquisition effort for effectively meeting current and future national requirements. Understanding one system will help NGA to understand the others. The KOMPSAT-V payload, for example, will be derived from the Cosmo SkyMed system. Cosmo SkyMed will consist of three more identical satellite systems like the one being evaluated by NGA. Cosmo SkyMed-2 is expected to be launched in December 2007, and Cosmo SkyMed missions 3 and 4 are expected to be launched in 2008.

Challenges and Opportunities for NGA

While the proliferation of foreign commercial SAR data provides many opportunities for NGA, it also creates challenges. These include development of a foreign SAR tasking, processing, exploitation and dissemination process; managing multiple unique data licenses from numerous non-U.S. vendors; ingesting commercial SAR data into the National System for Geospatial Intelligence architecture; and understanding how non-U.S. access to non-U.S. systems may provide possible advantages (especially asymmetric ones) to our adversaries. Continuing to acquire, evaluate and understand the characteristics and capabilities of foreign commercial SAR data will help NGA better address all these challenges in a manner that best supports the U.S. warfighter and our coalition partners. �

MICHAEL HALES
is an NGA Staff Officer in the Policy Division of the Office of International Affairs and Policy.

Achieving Persistent Surveillance Requires Community Effort to Build One Continuum

By Patrick A. Grieco

"Look long enough, often enough and with enough fidelity to achieve the mission requirement."

That's a shorthand definition of "persistent surveillance." NGA defines it as "assured monitoring of entities and environments with sufficient frequency, continuity, accuracy, precision, spectral diversity and data content to obtain desired information, even in the presence of denial and deception."

Persistence is situational in nature: How an object or target is surveiled will depend on the information needed. Persistent surveillance must be sustained for the period of time appropriate to mission need, be it minutes, days, weeks, months or even years. It is possible to achieve persistent surveillance through a combination of sensors and tasking, collection, processing, exploitation and dissemination (TCPED) activities.

Leveraging Saturated Collection

Taking data from multiple assets, correlating it as much as possible and fusing it to obtain a more comprehensive view of the environment under surveillance can provide a clearer understanding of events and indications and

may detect the significance of an event (for example, a truck entering a facility) that no single asset by itself may be capable of providing.

Using current tasking mechanisms, collection managers may saturate an environment with a combination of land, sea, air, commercial and national sensors as available and appropriate for the area, object or facility under surveillance. These mechanisms are in reality a series of collection-management processes at the unit, theater and national levels, tied together to form a greater whole.

Individual units maintain control of limited numbers of operations intelligence, surveillance and reconnaissance (ops/ISR) assets, which they use to address their information requirements. Units pass their unmet information needs to the command- or theater-level collection manager for resolution at that level.

Theaters maintain control of a different set of ops/ISR assets to support information needs adjudicated and prioritized through a joint collection management board (JCMB). The board passes information needs that can't be addressed or resolved at the theater level to the national level for resolution.

The national level uses a central tasking and adjudication process that receives, adjudicates and prioritizes global requirements and tasks collection requirements to available assets. This process is transitioning from today's manual and semiautomated mechanisms to a more net-
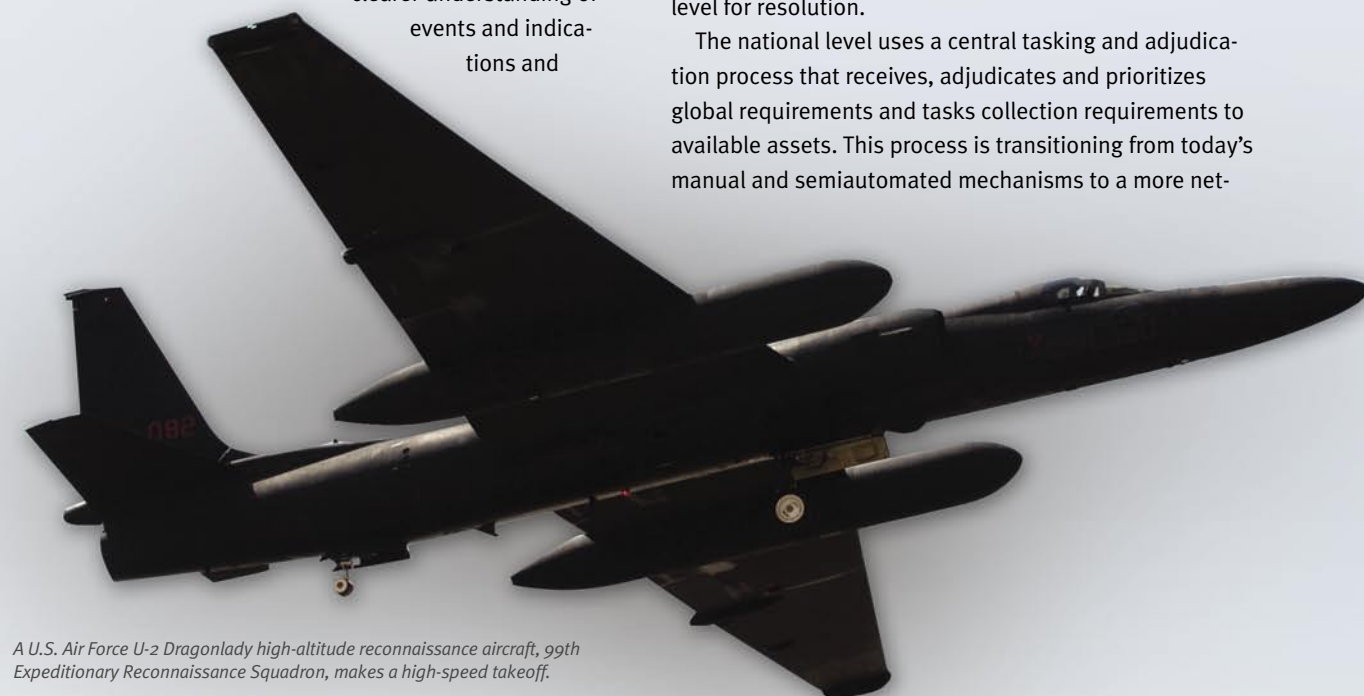
A U.S. Air Force U-2 Dragonlady high-altitude reconnaissance aircraft, 99th Expeditionary Reconnaissance Squadron, makes a high-speed takeoff.

DoD photo by TSGT Erik Gudmundson

centric, machine-to-machine process designed to maximize the efficiency of cueing and tasking by minimizing human influence in the process.

National information needs best suited for collection by theater assets are passed to the theater level by means of "advisory tasking." This essentially is the reverse of the national collection management process in that national needs passed to the theater are subject to the JCMB process before possibly being addressed through use of theater-or-below ops/ISR assets.

The objective is to make the links between these disparate processes as seamless as possible, feasible and appropriate. The same requirement that will provide actionable information to the unit user may provide critical forensic-level data to the rear analyst. The end-to-end collection management and tasking process needs to be automated to the extent possible and prudent to remove barriers to the use of assets to address user needs. Moving beyond advisory tasking increases the transparency of national information needs in theater-level collection. Automation of end-to-end collection management and tasking would also mirror, where appropriate, national process improvements in theater processes.

Once collected, new data can be compared or fused with existing archives as part of the analysis process. Thus, how data is managed is critical to its availability, accessibility, utility and interoperability.

Removing Impediments to Interoperability

NGA has been involved over the past several years in the convergence of hardware and infrastructure to consolidate and merge systems inherited when the Agency stood up. While this infrastructure convergence is a positive development for persistent surveillance, the interoperability that is required also depends on data convergence.

A horizontally integrated exploitation environment should encompass data streams, data processing, data storage and archiving, data dissemination to users, data manipulation by those users and the ultimate creation of products using data transparently from across the spectrum of intelligence disciplines.

Data convergence will provide interoperability through the creation, promulgation and enforcement of data standards within and between spectrum disciplines. Interoperability will allow for the creation of a common processing environment where data from multiple sensor systems can

be treated identically, making it transparent and to some extent interchangeable to the user as it is correlated, fused and layered in displays, visualizations and other products during the analysis process.

Common data formats will enable the automation of exploitation tools into a common suite. Common data formats will also enable the creation of common storage and archive practices and methods for both the data itself and the various products derived from it. Fused, layered, multi-intelligence (multi-INT) products will be the ultimate result of user interaction with this converged data within the horizontally integrated exploitation environment. NGA's InnoVision Directorate is leading the development of community standards at the level of metadata (descriptive data about data). However, much remains to be done to achieve cross-spectrum, multi-INT data convergence.

Maximizing Access to Tactical Collection

Achieving data convergence in a common exploitation environment doesn't necessarily mean that users will have access to all the data they need to adequately address mission problems. There is a plethora of platforms at the national and tactical levels, but the data from each platform does not necessarily go beyond the immediate user for that data. Tactical systems may provide information to a relatively small number of immediate users who do not store or archive that information for later use. Rather the data "falls to the floor" after use and is lost to others for further analysis or exploitation in conjunction with other information sources.

A classic example of this occurred with the use of ground-moving target indicator (GMTI) data. GMTI is a radar technology that detects, locates and tracks moving vehicles and vessels. The Joint Surveillance and Target Attack Radar System (JSTARS) used GMTI operationally for the first time in 1991 during the Persian Gulf War. However, only starting in 2004 were provisions made to ensure that GMTI data was kept and archived at the national level and made available to researchers and analysts for development and use in intelligence applications. Today, the use of GMTI data is becoming widely accepted as a part of many types of mission-support analysis.

Tactical data such as GMTI data may have enormous application on a broader analytical stage. Thus it is crucial to incorporate tactical collection into national archives wherever possible. This broadens the base of information

available for multi-INT fusion-based analysis by a wide range of analysts working both tactical and national mission problems. For example, in rolling exploitation, available data is used to build on the existing understanding of an environment or battle space. A single piece of data five days old could be the missing piece of a puzzle that allows actionable intelligence to be produced and provided to warfighters, allowing them to take preemptive or proactive action against a particular target set.

It is not enough to increase the flow of tactical data to national archives, however. Users, who may be widely separated on an organizational level, must be able to exploit and share the data with interoperable tools, whether they are sitting in the Washington, D.C. area or Bahrain.

Part of the challenge is to move the data from point A to point B without loss of data coherence, resolution and structure. Due to the complexity and high volume of data, with multiple sensors employed against a single-mission problem, persistent surveillance increases the demands placed upon communication infrastructures. Sensors like electro-optical full-motion video systems place a high demand on in-theater and theater-to-national communications capabilities, due to large raw and compressed data-file sizes. Larger data files will stress communication capabilities as operators seek to retrieve data from one place and deliver it to another in a timely fashion.

Whether or not cable, microwave or satellite communications are used, the data needs to be sized to fit the existing bandwidth, or the bandwidth needs to be increased to meet the increased requirements. In short, it is imperative to ensure data receipt with no loss of functionality.

Making Data Available

Having the ability to move data without loss of functionality leads to the challenge of ingesting it into a storage and archive system that allows for meaningful retrieval. Storage capacity must be easily expandable and adaptable enough to accept new data flows and emerging data formats.

To enable standards development and interoperability, metadata (information about a dataset) also needs to be preserved. Formulation and adherence to developed standards at the metadata level will provide the basis

Global Hawk in flight.
Photo by the U.S. Air Force

for universal data interoperability across the intelligence and spectrum disciplines. Ensuring metadata is available for all data types enables advanced processing such as data conversion, translation, correlation and fusion.

Some applications might require an unconstrained, machine-language flow of data, unsuitable for unaided human use, in order to mine for specific information types. However, most data is retrieved in finely focused segments relevant for a specific mission. Even with most exploitation today being computer-aided or enhanced, the Mark 1 eyeball is still relied upon for the examination and analysis of imagery.

The type of analysis being conducted also may well impact how the data needs to be archived. Data correlation and fusion are basic elements of modern analysis (nodal, pattern, change detection, etc.). Therefore, data must be archived in a manner that allows for the transparent merging of different data types in a common processing and exploitation environment.

Early involvement in the development of new sensor systems provides an opportunity to influence their development and enables analysts to get the new data in the earliest time frame to develop transition and permanent archiving mechanisms for the data. Having the data available early also enables the use of existing and evolutionary data sources in revolutionary ways previously not thought of or not possible because the data was simply not available for use.

Moving to Rolling Exploitation

Despite today's rapidly changing environment, the traditional phases of exploitation are still valid. The quick look at the tactical level, followed by a more extensive review and analysis, and finally the long-range review and exploitation to address a particular mission problem or aspect of an ongoing operation continue to meet critical information needs at all levels.

At the same time, these traditional phases have merged into a continuum, blurring the traditional distinctions between them. Just as first- and second-phase exploitation enable the third-phase work, third-phase efforts now enable first and second phase-like activities. Data having time latencies is still important for forensic analysis and exploitation because it may provide the one critical piece of information that may be the key to supporting current operations.

A transition is under way to a continuous process of rolling analysis or exploitation, which occurs where existing information is overlaid and combined with newly captured and archived data in multi-INT and all-source analysis. Each data segment increases the overall picture and understanding of the mission problem, enabling planning and operations against an agile and adaptive foe.

As data becomes available, it can be used in a mission-layering approach, enabling different tasks based upon resolution and format. Data mining, visualization and smart-agent applications, such as notifying analysts of activity in their area of interest, allow different layers of the mission problem to be addressed with increasing degrees of accuracy as analysis and emerging data combine to help resolve difficult aspects and operational enigmas.

Rolling analysis supports the full range of analytical and operational functions:

- » surveillance and targeting
- » temporal analysis (an event- or network-based activity enabling tracking of objects forward and backward in time within a defined geospatial reference)
- » change-detection, geospatial-trend, nodal, normalcy, pattern and traffic analysis
- » case studies in areas of interest.

Rolling analysis is consistent with the use of different sensors for different tasks. Different sensors have different resolutions, spectrums and fields of view. A comprehensive persistent-collection strategy should leverage these differences to provide a layered mix of data, giving analysts a more comprehensive view of their environment and allowing them to fuse different types of data.

Within this continuous analysis process, federated exploitation leverages hands-on in-theater experience and rear-area depth of analytical support and assets to maximize the exploitation effort at each organizational level. It takes advantage of the strengths of all parties and, when mixed with judicial provision of forward-deployed national

analysts, provides a layered, in-depth capability to address all aspects of the mission problem.

Summing up

Surveillance by its very nature is ambiguous. It may not impart the nature or meaning of an observed activity. Only by combining the power of persistent collection with in-depth capabilities to find, retrieve, fuse, analyze and disseminate needed data and products is it possible to approach clarity. Each element of sensor and TCPED configuration must be optimized to provide a seamless flow of data and products addressing mission problems.

No definition of persistent surveillance by itself adequately captures the details that need to be in place to truly create such an environment. And "the devil is in the details," as the old saying goes. Limited, localized persistence may be achieved today by being conscious of all the elements required to bring the full force of sensors, data and analytical expertise to bear against a mission problem. However, true persistence will not be achieved until sensors and TCPED are combined into a single continuum, from collection strategies to the production of relevant, actionable intelligence products, even in the presence of denial and deception.

Although vital to successfully meeting the challenges of today and tomorrow, achieving persistence is not a trivial or short-term undertaking. It will require a long-term focusing of resources and personnel in a robust, concerted, and comprehensive community effort. ⊓

Patrick A. Grieco

is a Principal Member of the Professional Staff of the Riverside Research Institute, an independent, not-for-profit scientific institution that primarily supports customers in the Department of Defense, Intelligence Community and National Institutes of Health. At NGA he is supporting the Imagery Studies Division of the Analysis and Production Directorate's Analysis and Integration Center.

Changes in SI Will Be Transformational

By Kate S. Worley

As the Director of NGA's Security and Installation Operations Directorate (SI), retired Brig. Gen. Joe Composto ensures that NGA people, facilities and systems are secure. He assumed the SI directorship in 2003, after retiring from a 32-year career in the U.S. Marine Corps. His last military assignment was Commanding General, Marine Corps Base, Quantico, Va.

The SI Directorate's mission is "to secure NGA people, facilities and systems while providing a safe and efficient operating environment." SI's government and contractor personnel are working together to provide installation operations, facilities management, security and counterintelligence services across NGA.

Q: Sir, what are the plans for enhancements and upgrades to NGA facilities and security at the New Campus East (NCE) in Springfield, Va.?

A: The NCE presents a once-in-a-lifetime opportunity for NGA. A move of this scale is something that comes along for an agency maybe once every generation or two. It is going to give us the ability to remake the way we do business. Over the last 10 years, we have successfully integrated eight separate organizational cultures under the NGA umbrella, but geographical dispersion remains an issue. Consolidating our eight Washington, D.C., offices at the NCE will enhance our ability to collaborate and cooperate with one another. The new facilities will provide our workforce with the newest technological advancements in our tradecraft and are purposely designed for the production of geospatial intelligence (GEOINT). The new facilities

Photo by Rob Cox

Retired Brig. Gen. Joe Composto , SI Director

are designed so that we can grow with the advancements of technologies, and the ability of our workforce to apply their trades will be greatly improved. I will say that the final modern benefit of the new campus will be the enhanced workplace security. We will be far better protected from terrorist threats, espionage and other criminal activities. The location of the NCE is more secluded, and we will employ the most modern and latest security features and devices.

Photo by Larry Franklin

Q: Are there any plans for upgrades and enhancements to facilities and security at NGA West campuses?

A: Upgrades and enhancements are already under way at the west facilities. NGA West is a vital component of the Agency and we have not forgotten them. Many of the improvements to our west facilities are behind the scenes, such as new plumbing, electric, heating, ventilation and air conditioning. Improvements and renovations continue at our Second Street location in St. Louis. There, you will have a hard time walking down any hallway without seeing work carts and areas under construction. We continue to initiate enhancements to areas like the fitness center, cafeteria and hallways. We've opened a new mail handling facility at Arnold, and we are in the process of obtaining more parking and developing a conference center at Second Street. Additionally, the security at our west facilities is becoming more robust. NGA wants to make certain that all our facilities, both east and west, are capable, attractive and safe.

Q: NGA has been transitioning to a new Data Center in the west. What are the benefits of this move?

A: The new NGA Data Center we have built in the west is a big part of NGA's future ability to gather, protect and disseminate geospatial data. This center is very much part of our plan to transition and deploy to the NCE. As we prepare to move to NCE, the majority of the various libraries and data systems will be moved to the Data Center West to ensure they remain stable and secure. We can't afford the luxury of packing our boxes and closing down for a few weeks while we move. We must be able to continue to operate at an optimal level and the Data Center is going to play a big role in our successful deployment.

Q: Could you tell us a bit about NGA's Radio Frequency Identification (RFID) initiative?

A: Simply stated, RFID will better enable NGA to track the location of all the accountable and reportable property we have in our trust. Essentially, we place a small radio tag that emits a very weak signal on each piece of accountable property. That signal sends out the property number to receivers stationed around the building, allowing us to take a real-time inventory of our property. We have a pilot program under way at the Washington Navy Yard. The pilot has been very successful, and we are planning for the deployment of RFID at NCE and at our facilities in the west.

Q: Over the past 10 years, how has NGA developed and evolved to become a more robust, efficient and secure intelligence and combat support agency?

A: NGA security has developed quite a bit, especially since 9/11. There have been a number of visible changes in our security such as the various barriers, gates and turnstiles that have been installed. We have also made changes around the Agency that are not as visible but have greatly improved our ability to protect our people and our property. We have increased the size of our security police force and have improved their training. NGA's highly trained and motivated security police force does a superb job and, in my judgment, is the finest that you will find anywhere in the federal government. Additionally, our counterintelligence office within NGA is working hard to deter and defeat espionage, and our counterintelligence program has quickly become a showcase for the counterintelligence field.

Q: What are some of SI's success stories since you became Director of SI four years ago?

A: The men and women of SI are my success stories. There is no doubt that they have done an outstanding job in the time I have been here. They are a very talented and energized workforce, and I enjoy working with them. Additionally, there have been dramatic improvements and renovations to the exteriors and workspaces at all of our NGA locations. I am also extremely proud of the improvements to our security—the safe and secure working conditions at NGA today did not exist a few years ago. We have also pursued and implemented our own security- clearance adjudication authority for NGA, a real milestone in becoming a world-class intelligence agency. I truly believe I have the best job in the Agency, and SI will continue to enhance, develop and secure our facilities in support of the GEOINT mission. ⊓

KATE S. WORLEY supported the Office of Corporate Relations with speechwriting. She was a senior strategic communications consultant with an NGA contractor.

Photo by Tony Boone

GST Helps Iraq Build GEOINT Capability

BY GEOSPATIAL SUPPORT TEAM 32

NGA's Geospatial Support Team (GST) 32 in Iraq recently completed a leadership change. Exiting the relative safety of the Baghdad International Zone, still referred to as the Green Zone, team members drove to the nearby Red Zone to introduce their new leadership to Iraqi counterparts. There, they made contact with Army leaders building the Iraqi Directorate of Imagery and Mapping Intelligence Affairs (DIMA).

Besides supporting the Multi-National Security Transition Command-Iraq (MNSTC-I), GST 32 interfaces directly with members of the Ministries of Defense and Interior to facilitate DIMA's rise. In short, GST 32 is charged with assisting the establishment and standup of an Iraqi geospatial intelligence organization.

GST members work under the watchful eyes of U.S. Army Lt. Gen. James Dubik, head of the Transition Command. The MNSTC-I mission is to assist the Iraqi government in the development, organization, training,

equipping and sustainment of Iraqi Security Forces and ministries. That makes the GST a close partner defeating terrorism and providing a stable environment in which representative government, individual freedom, the rule of law and a free market economy can evolve. The team also hopes to contribute to Iraq's external security and the security of the Gulf Region.

GST 32 is assisted by a large NGA in-country support structure and the U.S. Central Command NGA Support Team.

The prognosis for the standup of DIMA is guardedly optimistic. The Iraqis must overcome many challenges such as power generation and personnel shortages. NGA has given the Iraqis a leg up with data and the capability of viewing and doing some simple analysis. This progress was achieved because of the close and personal interface the team maintains with their Iraqi partners, which is so important in Arabic culture.

GST 32 is one of a handful of teams that have a six-month tour length instead of the usual four months. A six-month deployment counts as a one-year joint duty assignment. GST 32 is an NGA Volunteer Deployment Team supported by NGA's Office of Global Services.
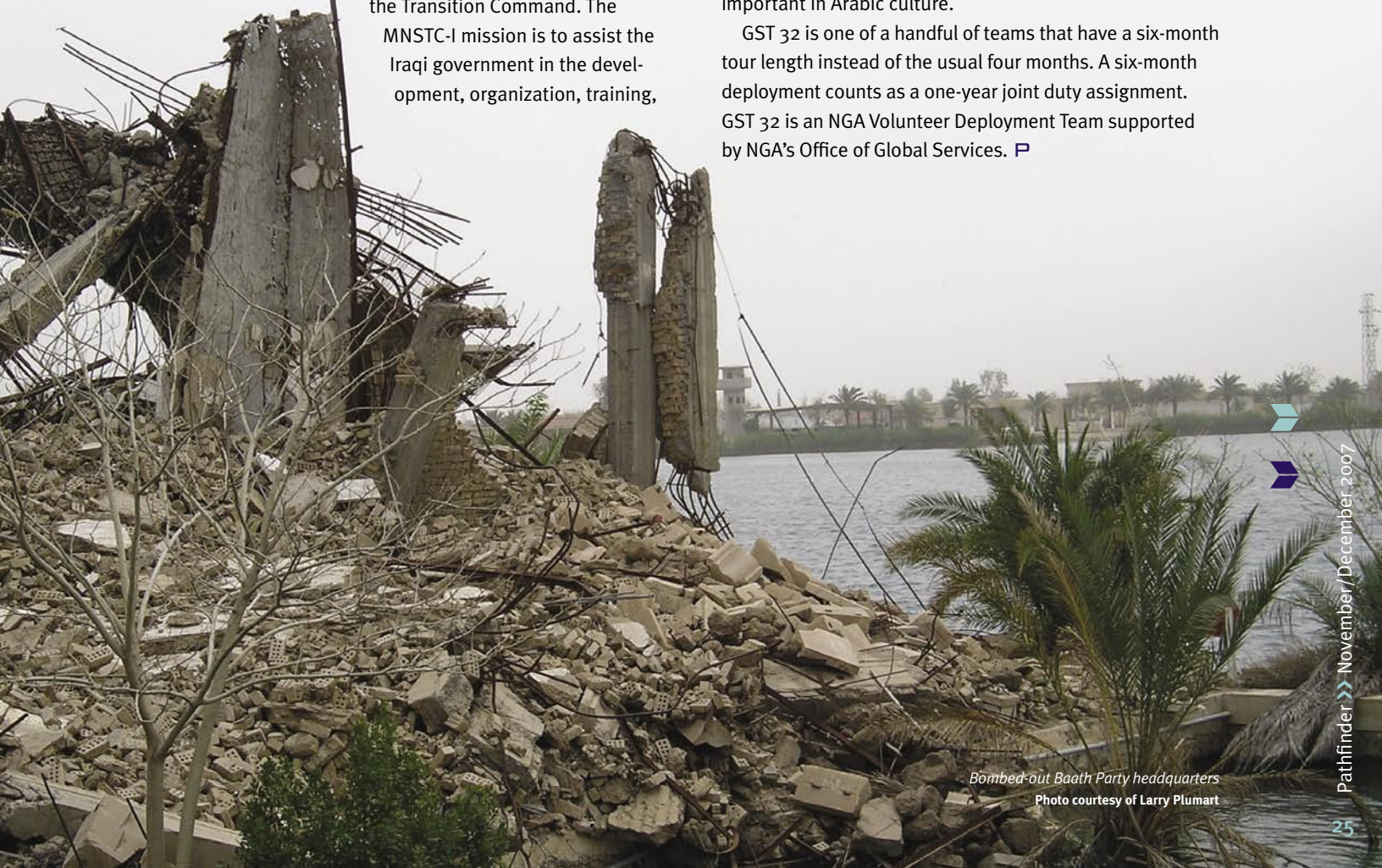
Bombed-out Baath Party headquarters
Photo courtesy of Larry Plumart

Telling Agency's Story Has Its Proud Moments

By Kensey Liebsch

"How did I get here?" I asked myself in late August, as I walked through the French Quarter in New Orleans. The humidity was so thick it was visible, the temperature was nearly 100 degrees, and my body was so warm that I panted even thinking about walking outside. But I was having a great time. I was attending Synergy '07, my first conference as an NGA ambassador.

Co-sponsored by the Office of the Undersecretary of Defense for Intelligence, Government Emerging Technology Alliance and National Military Intelligence Association, Synergy '07 focused on the use of technology to provide synchronized support to the warfighter.

I was at Synergy '07 as a member of NGA's Ambassador Program, sponsored by the Office of Corporate Relations, through which a cadre of employees represent NGA at conferences across the country.

While managing NGA's booth, I felt the excitement surrounding NGA's products and successes. I fielded countless questions from conference attendees about NGA's project with Google Earth™, how private companies may access unclassified NGA products and how small businesses can participate in the NGA mission. I was delighted to witness the high esteem in which members of the defense and intelligence communities held NGA.

Holding the conference in New Orleans on the second anniversary of Hurricane Katrina was poignant for many attendees. NGA's contributions to the recovery effort mark the time I was most impressed by our geospatial intelligence (GEOINT) mission. At Synergy '07 I learned that many others feel the same way.

My favorite moment occurred during the lunch break on the conference's second day. I was at the NGA booth, and the exhibit hall was mostly empty of attendees. Army Lt. Gen. Russel L. Honore, commander of Joint Task Force Katrina, approached to tell me how much he appreciated the support that NGA provided following the catastrophe. The pride that I feel about working for NGA swelled at that moment.

Photo by Charles Monroe

Kensey Liebsch represents NGA at Synergy '07 in New Orleans through the Ambassador Program, sponsored by the Office of Corporate Relations.

Reflecting on my experiences at Synergy '07, I saw clearly that NGA and the Ambassador Program provided me with an opportunity to spend a few days doing something that I care about: explaining the GEOINT mission to audiences who partner with NGA to support our warfighters. P

Kensey Liebsch is an NGA Staff Officer in the Analysis and Production Directorate, Office of Plans, Resources and Metrics.
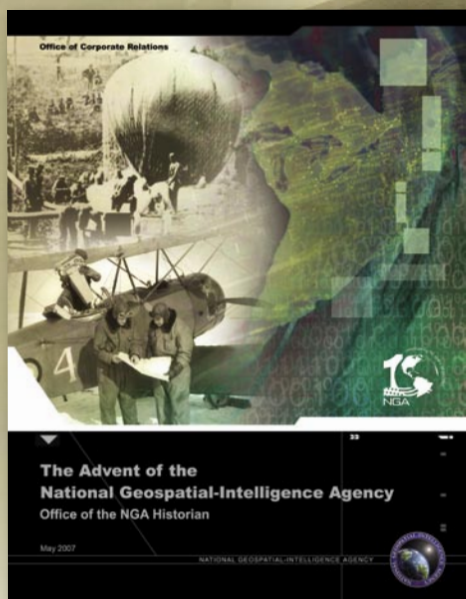
What Is 'Doing History'?

By Dr. Gary E. Weir

Doing history. That sounds odd, doesn't it? It seems normal to read history, write history, and make history, but how does one do history? The Renaissance scholar J.H. Hexter of Washington University in St. Louis gave the title of this essay to a book he wrote years ago on the process of historical analysis. That book is a favorite of mine, and yes, I said analysis. People think of historians as collectors of old documents and old books, with old minds, gathering the past and knowing its facts and events for their own sake. This same perspective often equates history with the past. We tune into the History Channel, and the announcer tells us that this is "where the past comes alive." Well, if you ever see the past come alive, try to escape because you have just walked into the plot of a Stephen King novel! The past has definitely ended. However, the history we do relative to that past has only just begun.

History happens in each moment of every day when a qualified historian examines the sources left behind and offers a perspective on the past, in any of its aspects, that enables us to better understand ourselves and our world.

Historians use a variety of research techniques and analytical methods to evaluate and understand the past for itself, to employ that understanding to better appreciate the present, and to plan more effectively for the future. Oral history interviews, documents, any sort of media, and artifacts provide the historian with the raw material needed to do history.

Mastering the historical sources on any given subject usually provides scores of surprises, as well as a depth of insight few of us ever achieve. A few years ago I flew to San Diego to do some documentary research at the archive of the Scripps Institution of Oceanography in La Jolla. I also had an oral history visit

The Advent of the
National Geospatial-Intelligence Agency
Office of the NGA Historian

May 2007

NASA Image, © 2007 DigitalGlobe
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NGA employees can open the door on a special episode of NGA's past, just as an eyewitness account of the Bolshevik Revolution brought new meaning to landmarks depicted in the above satellite image. The landmarks include the (1) The Neva River, (2) Russian Admiralty, (3) Winter Palace Square, and (4) Winter Palace, now the Hermitage Complex.

scheduled with a retired physicist, Victor Vacquier. My visit to his home provided surprises on a number of levels and brought me to an unexpected understanding of a topic I never planned to explore with him. First, I discovered that Dr. Vacquier could no longer see. This disability had dampened neither his spirit nor his lively manner, and he quickly took me to his favorite room in the house for our conversation. I soon found myself sitting in the basement laundry room next to the clothes dryer! He had his favorite easy chair just opposite and a cool drink waiting.

As I asked him questions about his early life for context in an effort to appreciate his capabilities as a scientist, I learned that he did not come to this country in his youth from France, but rather from Russia. Since my subject had already entered his eighth decade, I also realized that the Russia he remembered lived under the last czar and the name of his home town, St. Petersburg, had not yet become Leningrad. Then to my astonishment he recalled at length standing at the window of his grandmother's apartment in 1917 watching the Bolshevik Revolution occur as thousands of people passed by on the street below headed toward the czar's residence. I had studied that revolution many times in college and graduate school, but I never saw that event, its people, their manner, or their clothing, or heard the words they called out in the cold night air as well as I did that day listening to the sharp childhood memories of a scientist whose eyes no longer

served him. The Soviet Union at its beginning now has a depth in my mind achievable in no other way.

At NGA, we're doing history in a variety of ways. During the past year we celebrated the 10th anniversary of geospatial intelligence (GEOINT), documenting the highlights of the first decade of this remarkable young intelligence specialty. Our new Time Cabinet, holding tools, products, and other artifacts of our GEOINT tradecrafts, is currently touring our facilities to mark the closing of the 10th anniversary celebration. At NGA's St. Louis facility, new exhibits appear three times each year at our on-site museum, which is open to staff always and to other visitors by appointment. We also made available a short analytical survey of our history entitled, The Advent of the National Geospatial-Intelligence Agency.

Just as we need data sources for GEOINT, we need people for history. As we identify insightful expert employees at NGA who can open the door on a special episode of NGA's past, we turn their memories about how NGA and GEOINT have fit into our nation's history into historical sources. My office is also publishing original articles and research in an internal newsletter and on NGA's internal Web sites, with a new history Web page forthcoming. In addition, a new, fully animated online virtual museum is now in development. By "doing history" as we live it, we can understand, as never before, the richness of our Agency's heritage. ⊓

DR. GARY E. WEIR
is the NGA Historian.

Testbeds Turn Difficult Challenges Into Practical Solutions

By Shawnarah Kelly

NGA's Geospatial Intelligence Advancement Testbeds (GIATs) are laboratories—not the traditional kind with beakers and lab coats—but the kind where computers and networks serve as the main tools. As with all laboratories, they are staffed with experts and idea people who have a passion for science, innovation and discovery.

The acronym GIAT refers collectively to 10 labs located across the country to exploit expertise and assets throughout the Intelligence Community and five nodes embedded within the customer community abroad. GIAT is a service-driven focal point for innovation within the field of geospatial intelligence (GEOINT), excelling in prototype development, applied analytical research, technical studies and evaluations, and risk-reduction activities. While each lab contributes uniquely to the GIAT program, all

collaborate to bring synergy of talent and resources into play for timely solutions to tough problems. Simply put, GIATs discover the possible and make it practical.

A Bustling Conglomerate of Working Labs

Organizationally the GIAT program is executed as a division within the InnoVision Directorate's Information Integration Office. A quick tour through the sites, with a glance at a selected project or focus area, will serve to illustrate the breadth, value and wide-reaching impact of the GIAT.

At the National Reconnaissance Office, GIAT personnel collaborate with lab members of the Rapid Response Operations Center. Together, they have developed a system that provides report feeds in near real time from multiple sources into one environment. It's called the Time Dominant Alert Message System.

NGA's Geospatial Intelligence Advancement Testbed excels in prototype development, applied analytical research, technical studies and evaluations, and risk-reduction activities.

Photo by Tony Boone

Persistent Surveillance Lab

The newest GIAT is at the National Air and Space Intelligence Center in Dayton, Ohio. Here NGA scientists will be developing the possibilities of advanced geospatial intelligence, also known as AGI, including overhead non-imaging infrared (ONIR).

The GIAT in Denver focuses on identifying new methods of merging intelligence data in a GEOINT framework. This GIAT collaborates with other Intelligence Community (IC) agencies to support a number of projects, such as the development of tools to more effectively use ONIR. GIAT scientists here are driving work the ESRI Center for Innovative Geospatial Technology is doing for NGA to enhance the company's software to address IC requirements.

The GIAT at Fort Meade, Md., leverages close ties with the National Security Agency (NSA) to exploit source fusion and develop processes for advanced analysis. Besides researching the added benefits of signals intelligence, the GIAT here is expanding NGA and NSA's role in three-dimensional modeling, both for imagery and computer-assisted design.

In Reston, Va., the GIAT is really three entities: the GIAT front office, Geospatial Collaboration Initiative Laboratory (GCIL) and Persistent Surveillance Lab (PSL). The GCIL coordinates with experts in other countries on exercises of mutual benefit. The PSL is a showcase for special projects and exercises across NGA, as well as a development and test environment. PSL is currently hosting a number of projects. For example, Watch-It enables users to view the Earth through tree cover, while the Dot Matrix

Tool displays tracking data for moving vehicles detected through the radar technology called ground-moving target indicator.

The largest GIAT is in St. Louis. It develops tools to exploit all data sources and imbed them into the National System for Geospatial Intelligence. Analysts at this site are assessing the utility and impacts of Google Earth™ and other three-dimensional visualization technologies for operations of the Department of Defense and IC. A Google Earth™ pilot, launched from this GIAT, led to the offering of Google Earth™ by NGA.

NGA leverages expertise of U.S. Joint Forces Command through a GIAT in Suffolk, Va. This GIAT identifies opportunities to develop and insert emerging geospatial capabilities into joint experiments, exercises and demonstrations. It supports modeling and simulation-based operations and develops tools to ensure horizontally integrated GEOINT to and from the last tactical mile.

The GIAT at the Washington Navy Yard hosts a virtual lab to collaborate with U.S. allies. It also serves as a gateway to access IC resources and provides network infrastructure for the development of federated architecture and exploitation techniques.

There is also a Deployable Interoperable Node for GIAT Operations (DINGO), which is collocated with the combatant commands. DINGO provides warfighters overseas access to rapid prototypes, early access to non-baseline tools, and the ability to tap into the GIAT "brain trust" for solutions to difficult problems.

Turning Challenges Into Solutions

Reaching out across the defense and intelligence communities, the GIAT is a bustling conglomerate of working labs that act as a single entity to turn difficult customer challenges into practical solutions. Operating on networks at multiple security levels, the GIAT provides a robust, flexible and risk-tolerant environment, where scientists bring their wide range of expertise to bear on top-priority geospatial problems. ⊓

SHAWNARAH KELLY was an intern in the InnoVision Directorate. Valedictorian of her class at Chantilly (Va.) High School, she is now a senior at the College of William and Mary, where she writes for the newspaper Dog Street Journal.

Commercial Airborne: Completing the Picture

By Len LaFeir

A thriving commercial airborne industry has developed since balloon-borne Gaspard-Felix Tournachon captured his first images over Paris in 1858. Collected from a spectrum of available sensors, commercial airborne imagery can be tailored for many needs and mobilized as needed.

Modern commercial airborne collectors satisfy consumers of geospatial intelligence (GEOINT) with a variety of data products. Large and small companies with broad capabilities—over 100 in the United States alone—offer a regional, a national or an international reach. Multiple providers offer flexibility through state-of-the-art sensors on platforms ranging from helicopters to low-flying fixed wing aircraft to Gulfstream and Lear jets.

Commercial airborne offers unclassified, high-resolution, multispectral imagery that complements the requirements of NGA, other agencies and emergency responders. Analysts integrate commercial airborne and unclassified satellite imagery to create geospatial products used in the field for response and recovery.

For security and safety, commercial assets cannot be deployed over denied air space. However, the nonmilitary commercial airborne industry provides data for homeland defense, counterterrorism and counternarcotics, among other uses. Commercial airborne has supported relief efforts and damage assessments after almost every major disaster in recent years. Some companies fill a specific niche—such as the single-plane proprietor whose infrared camera precisely counts individual geese in a wildlife refuge.

Commercial airborne providers can fly under clouds and take off almost on a moment's notice. Following Hurricane Katrina, days of cloud cover minimized the ability of commercial satellites to fill the immediate damage-assessment needs of emergency personnel. Local commercial airborne providers offered immediate imagery collection along with historical imagery for comparison.

Responses to crises such as Hurricane Katrina and 9/11 have reminded the Intelligence Community (IC) about this effective and easy-to-interpret imagery source. However, commercial airborne data carries a price tag, just as commercial satellite imagery does, and may be subject to license restrictions. To ensure that emergency responses proceed without delay, NGA maintains relationships with commercial airborne providers.

GEOINT standards for commercial airborne imagery will increasingly ease its acquisition and distribution. NGA continues to improve the National System for Geospatial Intelligence architecture and implement image standards that facilitate the use of commercial airborne. As the use of commercial airborne imagery rises within the IC, its value and that of the GEOINT derived from it is likely to increase rapidly. ᴘ

LEN LAFEIR
has supported the worldwide remote sensing industry for more than 30 years, including 25 years with Kodak, where he was manager of Aerial Systems. Currently, as a contract employee, he supports the NGA Commercial Solutions Division.

NGA Updates Chief Information Officer's Role

By Kristen Mackey

Nothing is more essential to NGA's success in fulfilling customers' needs than information technology (IT). Vastly increasing volumes of data need to be moved, processed, exploited, stored and managed. The future IT base must be much more agile, reliable, capable and faster than the current system.

In Aug. 2007, the Director of NGA announced his decision to separate the Chief Information Officer (CIO) from the Enterprise Operations Directorate and bring the CIO into NGA's Executive Committee (EXCOM). That step was part of an ongoing effort to further strengthen the agency's governance processes, including the planning and management of IT and information sharing activities and initiatives.

Dr. Robert Laurine, former Director of Enterprise Operations, serves as the CIO. "It is vital to have a common IT infrastructure for NGA's global enterprise that is centrally planned, developed and operated. Further, as an agency, we must be much more cost effective, efficient, reliable and secure in the way we run IT (infrastructure and applications) to meet the requirements of our mission at the lowest cost consistent with that mission," he states.

The NGA CIO has full responsibility for the NGA infrastructure and applications and their continued evolution to support the mission. That responsibility includes the funding authority with the ability to evaluate IT business cases for approval as well as the follow-on responsibility to review progress on those business cases to ensure compliance to cost, schedule and performance measures through their life cycle. Programs will be started, continued or stopped base on the evolving needs of the mission of the agency. In addition, the CIO has assumed the roles of NGA Accreditation Approval Authority and Senior Risk Executive.

Another critical component of the CIO office is the NGA-wide IT governance process. In particular, the CIO will define the Capital Planning and Investment Control process as the vehicle to manage the full life cycle of cost, schedule and performance. The CIO will also seek to streamline and simplify the other aspects of the IT governance process to ensure the right projects to get the appropriate level of support in a timely manner across their life cycle, focusing on the rapid insertion of mission support tools.

Kristen Mackey is the Lead Communications Officer for the Office of the Chief Information Officer (OCIO). She previously served as a communications specialist for the National Center for Geospatial Intelligence Standards (NCGIS) in NGA's Chief Architect's Office, which now resides within the CIO.

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

GEOINT
It Makes the Difference

Deployed disaster analysts

Damage assessment graphics

Fire maps

Critical infrastructure graphics

Photo of California wildfires courtesy of NASA

Fighting Wildfires
NGA: Readiness, Response and Recovery

Photo by Cpl. Seth Maggard, U.S. Marine Corps

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